Why Kitchen Chemistry:

All undergraduates at Massachusetts Institute of Technology (MIT) have to take a one-semester course in general chemistry. The courses that satisfy this General Institute Requirement (GIR) are lecture and recitation based courses. There is no laboratory component associated with the GIRs. This 6-unit seminar was designed to give the students hands on laboratory experience in chemistry using food as the experimental material. Unlike traditional chemical laboratory experiments, all the experiments in Kitchen Chemistry are designed to be eaten.

Objectives:

This course is offered in the spring semester, so most of the students have completed their GIR in chemistry. They have learned most of the principles covered in this course. Because we are using food to demonstrate the chemical, and biological principles, the students are very interested in completing the laboratory. The experiments were chosen to be completed in the 2-hour meeting period with a one exception (bread). Each class period had a recipe that needed to be completed and questions about the lesson of the day needed to be answered. The students always worked in groups on the experiments and this allowed for further student interactions to occur.

In addition to having hands on edible experiment at the end of the class meeting, the students also learned some useful cooking skills. Each experiment had at least one chemical principle that was demonstrated in the experiment. For instance, we looked at biological leavening using yeast and used bread as our experiment. The questions for the week are designed to reinforce the chemical principles of the week. The students had readings from the textbook and on-line which enabled them to answer the homework questions.

During the 14 week term, we looked a wide range of principles including chemical leavening (baking soda and baking powder), extraction (tea and processing vanilla extract), formation of egg foams (meringues), food and interactions with your body (beans, beets and asparagus), how do we detect hot spices (salsa), oxidation and reduction potentials (guacamole), and prevention of bacterial growth (jam).

One of the highlights of the course is when the students bring in a student and they peer teach. The student chooses the chemical experiment that they will teach, prepare for the lesson, and then teach their student. It makes for a very busy day in class, but everyone seemed to learn. It is also a great way to publicize the course for next year. We have been able to recruit the next year’s class during this time.

Course outcomes:

The students filled in weekly logs (with the exception of the first week) with the question, what did they learn in class today? Because most of the experiments had some periods of class time when they were not actively doing the experiment, the students worked together in small groups to answer the homework questions. It was great to see groups of students working together on the homework and then enjoying their experiments.

From reading the weekly logs, it appears that the students learned the underlying principle of the day. They handed in their homework the week after the class.
The students were able to apply chemical principles that they learned in the GIR to a food experiment. It was also great to read about the students being able to use some of the examples we used in class on other classes.

This course is an excellent example of how active learning can happen in an environment that encourages creativity. The students enjoy the class and remember the principles we discussed for many years to come.